



OVER REVIEW ON NEEDLE LESS INJECTION AND MEDICATED TATTOO UPCOMING TRENDS IN DRUG DELIVERY SYSTEM

R.R.Shah*, S.A.Mohite, N.R. Patel

Adarsh college of Pharmacy, vita

ABSTRACT

Drug delivery system (DDS) plays a vital role and is way to deliver the desired drug to the desired organ and hence it is attracted by enormous scientist and researchers. This review describes about two novel approaches: 1) needle free injection technology and 2) Medicated tattoos. New drug delivery techniques aim to improve overall drug performance and efficacy, making patient's lives easier. Needle free injection technology is growing and has the potential to make the administration of medicine more efficient, safe and convenient. Needle-free liquid jet injectors have been used for more than 50 years for parenteral delivery of vaccines and drugs. Although excellent bioavailability has been reported for a number of drugs, occasional pain and bruising have limited wide acceptance of jet injectors. Today, they are a steadily developing technology that promises to make the administration of medicine more efficient and less painful. Transdermal drug delivery can improve the therapeutic efficacy and safety of drugs by more site specific way but spatial and temporal placement within body is required to reduce both the size and number of doses necessary to achieve the objective of systemic medication through topical application to the intact skin surface. Medicated Tattoos Med-Tats is a modification of temporary tattoo which contains an active drug substance for transdermal delivery. A comprehensive and thorough literature about medicated tattoo and needless injection is placed in this article

KEYWORDS: patient compliant, needleless injection technology, basic mechanisms, applications.

INTRODUCTION

The researcher are continuously trying through transdermal drug delivery system (TDDS) to invent new approaches that can effectively and painlessly deliver larger molecules in therapeutic quantities to overcome the difficulties associated with oral route, namely poor bioavailability due to first pass metabolism and the tendency to produce rapid blood level spikes. Transdermal drug delivery can improve the therapeutic efficacy and safety of drugs by more site specific way but spatial and temporal placement within body is required to reduce both the size and number of doses necessary to achieve the objective of systemic medication through topical application to the intact skin surface,

This review describes novel enhancement techniques with certain advantages of patient compliance and good therapeutic effect. Simplified model of the human skin for mechanistic analysis of skin permeation.

NEW APPROACHES IN TDDS

- Needle free injection technology and
- Medicated tattoos.

NEEDLE FREE INJECTION TECHNOLOGY

Injections are one of the most popular modes for delivering drugs in order to prevent and treat various diseases. But it has several disadvantages due to needle there are more chances of spreading disease and painful action. Some people mostly children get feared about injections. To overcome obstacles related to needle based injections, needle free injection technologies (NFIT) have gained popularity

Correspondence, Author:

R.R.Shah

vardhmanh housing society

mahavirnagar vita

shaha.rutu@gmail.com, 7798140483.

during the past few years and offer many benefits. These technologies are meant for injecting liquid formulations, as well as injecting drugs and vaccines in a solid particle dosage form. Needle-free injection systems are novel ways to introduce various medicines into patients without piercing the skin with a conventional needle. Needle-free systems were first described by Marshall Lockhart in 1936 in his patent jet injection. Then in the early 1940's Higson and others developed high pressure "guns" using a fine jet of liquid to pierce the skin and deposit the drug in underlying tissue.

Merits of needle-free injection

- Prevent the problem bleeding and disturbance in normal skin structure.
- Imparts fast drug delivery and hence enhance bioavailability when compared with invasive drug delivery systems.
- As it is delivered in dry powder form less chances of microbial growth especially for water sensitive drugs and hence more stability of formulation.
- Elimination of needle phobia especially in case of small children.
- Certain vaccines can be delivered by needle free injections as Immunization of influenza, tetanus, typhoid, diphtheria, pertussis, and hepatitis A vaccines

Demerits of needle-free injection

Method is costly.

All systems are not fitted into one size.

Need skilled person for operating.

Not use full in case of Intravenous route.⁽¹⁾



Fig. 1. Needle-less injection device

COMPONENTS OF A NEEDLE FREE INJECTION DEVICE

Needle-free injection devices consist of three (3) main components:

Component 1 - Injection device:

It consists of drug chamber and is designed such that self administration is possible. It is made up of plastic material. Most important character is sterility in case of injection and in case of needle free injection, it possesses sterilized needle-free syringe which is made of plastic.

Component 2 - Nozzle:

It is the medium through which drug passes and comes in contact with skin. The nozzle has an orifice through which the drug enters skin when injected. The diameter of orifice typically is 100 μm . The nozzle passes drug particles at a typical speed of 100 m/s with a depth of 2 mm. The mostly used orifice size is 0.127mm, comparable to a 25-gauge needle. Therefore this injection is painless and gives patient compliance.

Component 3 - Pressure source:

It is an important part of the operating needle free injection. With the help of force drug is delivered forcefully into the systemic circulation via the skin. The pressure source is present in the injection in form of a spring and is released by pushing a plunger to give the necessary pressure. The most popular gases used in devices are carbon dioxide or nitrogen. Pressurized metal air cartridges are often provided for access in portable units.

WORKING OF NEEDLE FREE INJECTION

- Piston creates strong pressure on a liquid reservoir in the nozzle, due to which jet comes out of the nozzle at high velocity (velocity > 100 m/s).
- With the help of jet and its higher pressure formation of hole takes place on skin which helps in administration of medicament.
- As the hole in the skin becomes deeper, incoming jet slows down due to the accumulation of liquid in hole and the progression of the hole in to the skin is stopped.⁽²⁾

TYPES OF NEEDLELESS INJECTION SYSTEM

They can be classified depending upon mechanism of providing the necessary energy like jet injectors based on high pressure of compressed gas, spring, loaded systems, shape memory actuation etc. Some of these are discussed below:

Jet injectors based on air pressure

Instead of needle it contains high pressure narrow jet of the liquid to penetrate the epidermis. It is powered by compressed air or gas supplied either by a pressure hose from a large cylinder or from a built-in gas cartridge or small cylinder. The first needle free jet injector was patented in 1960 by Aaron Ismach. It has wide application as administer vaccinations for smallpox and other infectious diseases.

Magnet based system

In such a type of devices propelling of the fluid through the actuator has speed close to that of sound. The actuator is a tiny, powerful magnet surrounded by a coil of wire which is attached to a piston inside the drug vial. It has been observed that the velocity can be modified by the amount of current used and thus creating waveforms in two phases. The initial high-pressure phase ejects the drug at a high-enough velocity to puncture the skin and reach the desired depth.

Spring based system

Such type of devices works on stores energy in a spring which is released by pushing a plunger to provide the necessary pressure. Each time the spring-load is activated, the spring must then be manually redrawn to be used for the next time. Such devices has advantage as being compact and of lower cost they are used primarily for subcutaneous administration of drugs due to less range of force and versatility.⁽³⁾

Laser-powered system

It consists of two chambers which are separated by a thin and flexible membrane. One chamber contains water that acts as the "driving" fluid and the other holds the drug. Each laser pulse lasts for just milliseconds and creates a bubble in the water due to pressure creates on the drug filled chamber causing the medication to eject out. It is mostly used by skin specialist for treatments.

Shape memory actuation system

It has an ability to generate high stresses and hence it is used as a method of actuation for a needle-less injection system. One example of the shape memory alloy is the nickel-titanium (Nitti). The principle behind this is that the alloy undergoes a phase transition when it is heated and gets transformed into a phase that is stiffer and thus the NiTi wire decreases in length and increases in width. Which provides the driving force for the actuation by pulling the cylinder and ejecting the drug out.⁽⁴⁾

MEDICATED TATTOOS.

Transdermal drug delivery systems are potential source of administrating drug through and have certain advantages as delivering therapeutically effective amount of drug across a patient's skin. Transdermal has advantage over needle injections and oral routes. It has great patient compliance and avoids demerit of oral route by eliminating fast pass metabolism. In case of TDDS, the drug must be able to penetrate the skin so that drug can easily reach the target site. Certain factors should be consider during using Trans dermal drug delivery as high potency, better permeability through skin and non-irritation for better compliance.⁽⁵⁾

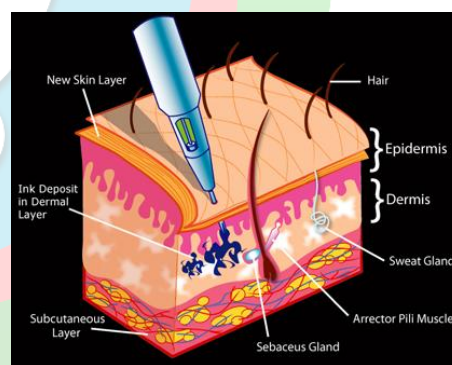


Fig. 2: Medicated tattoos

Medicated Tattoos is one of the upcoming approach in transdermal drug delivery. Medicated Tattoos Med-Tats is a modification of temporary tattoo, as normal tattoo are used for fun similarly Medicated tattoo contains active ingredient of medicament. It is easily attractable for small children who has fear of injection or other few drug delivery which are inconvenient for them. Several pharmaceuticals pay greater attention in case of choosing ingredient so as to increase penetration through skin mostly substances, like alcohol, within the patch to improve their penetration via skin in order to improve

absorption. Drugs and other compounds used in Med-Tats prototypes include acetaminophen and vitamin C.

Basic mechanism behind medicated tattoo⁽⁶⁾

- It is applied on clean and dry skin.
- A patch of tattoo is loaded with active medicament and applied on the skin to transport a specific dose of medication across the skin to obtain desired therapeutic effect.
- It contains adhesive that keeps the patch adhered to the skin, and also acts as the suspension that holds the drug.
- Manufacturer provides a color chart so that can be compared to the color of the patient's tattoo to determine when the tattoo should be removed.

- This visual comparison, which relies on the dyes incorporated into the patch, introduces a significant amount of inter patient variability

REFERENCES

1. Kale TR, Momin M, Needle Free Injection Technology - An Overview, *Inov Pharm* 2014;5:1: 1-2.
2. Chavan B, Doshi A, Malode Y, Misal B, Review on Needle Free Drug Delivery Systems, *International Journal of Pharma Research & Review* 2013; 2:9:30-36.
3. Kumar R B. Needle Free Injection Systems, *Av The Pharma Innovation*, 2012;1: 9.
4. Rajashree Hirlekar and Pheba Jose, Needleless Injection System *International Journal Of Pharmaceutical and Chemical Sciences*, 2013; 2:4:1857.
5. Roopal Pritam Kataria A Review: *Advances In Drug Delivery, Indian Journal of Drugs*, 2015;3:1:11-16.
6. Samant et al. / *Transdermal Drug Delivery System : Review, Journal of Pharmacy Research*, 2012;5:2:;899-900
7. Chinmaya Keshari Sahoo¹, Prakash Kumar Nayak², Tanmaya Keshari Sahoo³, Powshya Dasari⁴, Santhoshipriya Dandamund, A Review of Transdermal Drug Delivery System, *Journal Der Pharmazie Forschung (Formerly-Recent Advances in Pharmaceutical Science Research)* 2013;:2: 1.

